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(54) **VARIABLE REFRIGERANT FLOW SYSTEM**

(71) Applicants: **GD MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD.**; **MIDEA GROUP CO., LTD.**

(72) Inventors: **Junwei CHEN**, Foshan (CN); **Guozhong YANG**, Foshan (CN)

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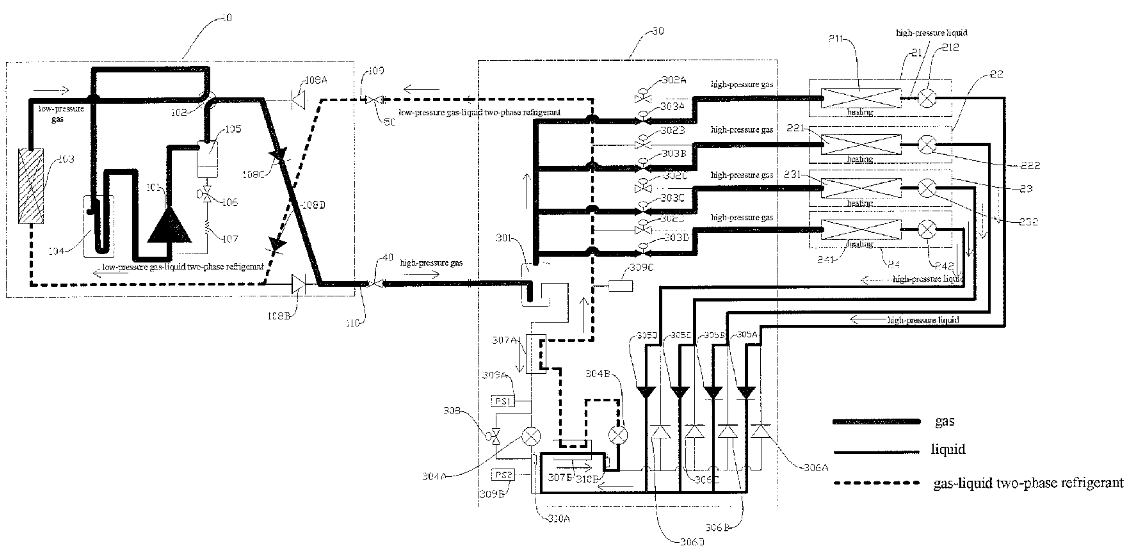
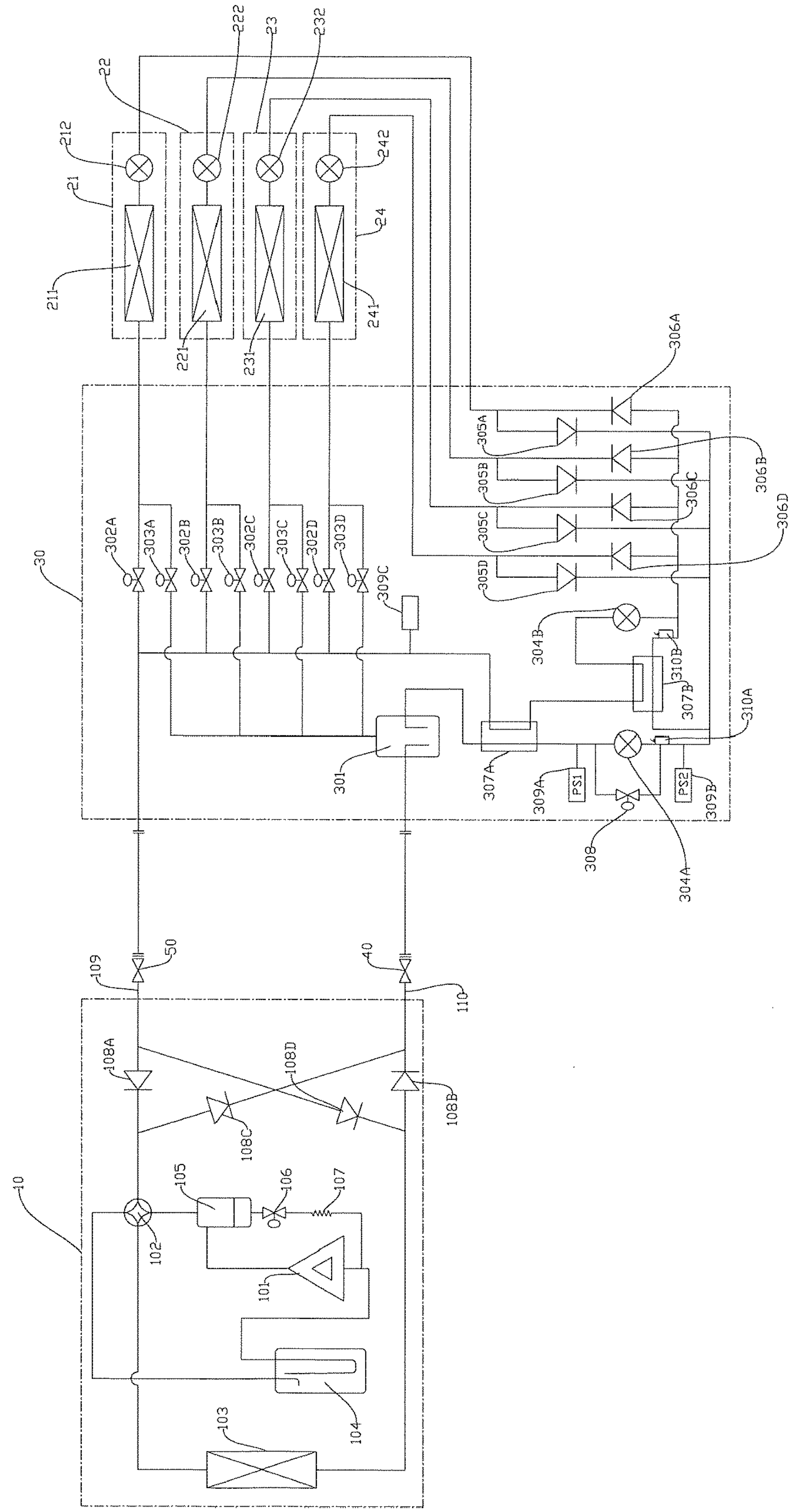
(57) **ABSTRACT**

A multi-split system includes an outdoor unit, a distribution device, a plurality of indoor units. Each indoor unit includes an indoor heat exchanger and a throttling element, and the distribution device includes a plurality of first controlling valves and a plurality of second controlling valves corresponding to each indoor unit. When any one of the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to the distribution device. The distribution device determines on or off statuses of a first on/off valve and a second on/off valve corresponding to the indoor unit according to the mode switching instruction.

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222
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302A
303A
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302C
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302D
303D
309C
305A
305B
305C
305D
306A
306B
306C
306D
304B
310B
307B
310A
301
307A
309A
PS1
PS2
309B
308
304A
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108A
108D
108C
108B
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105
106
107
102
101
104
103

Fig. 1

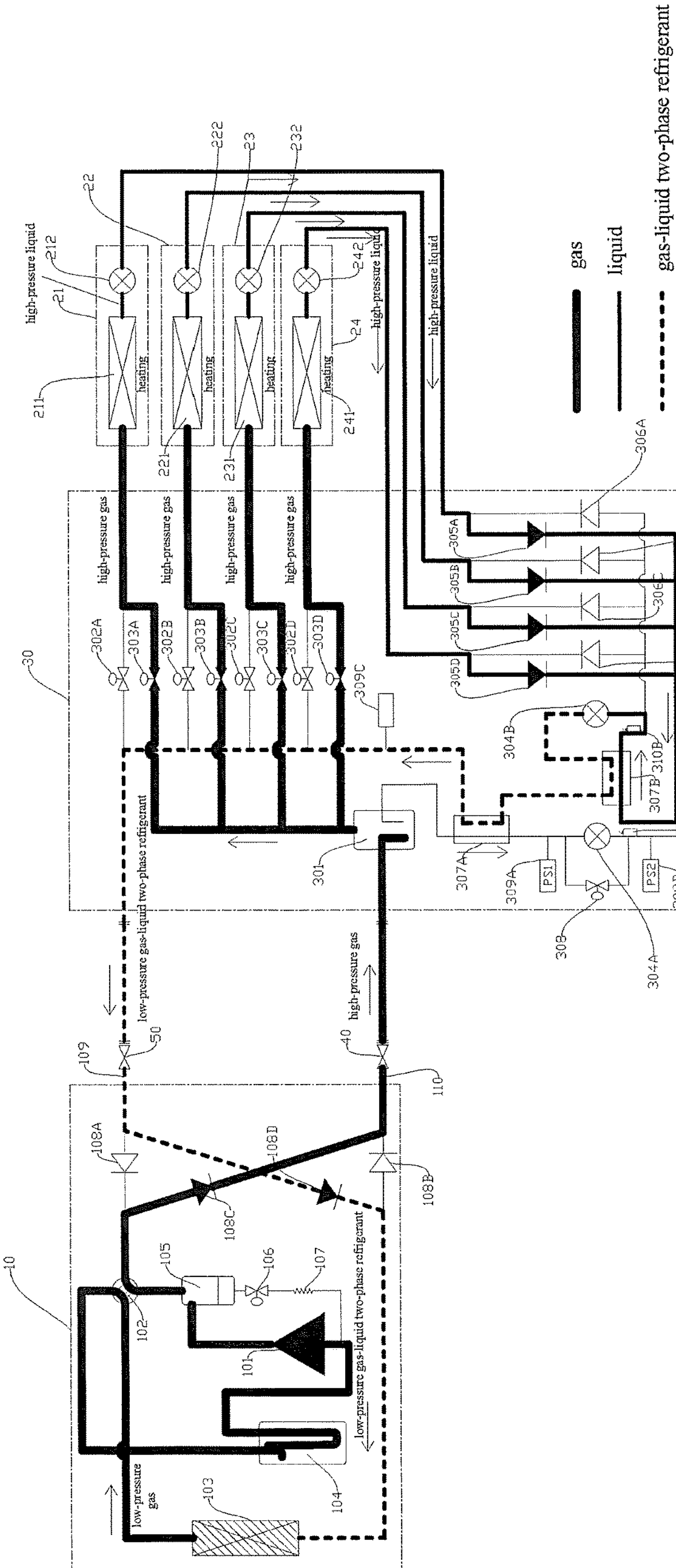
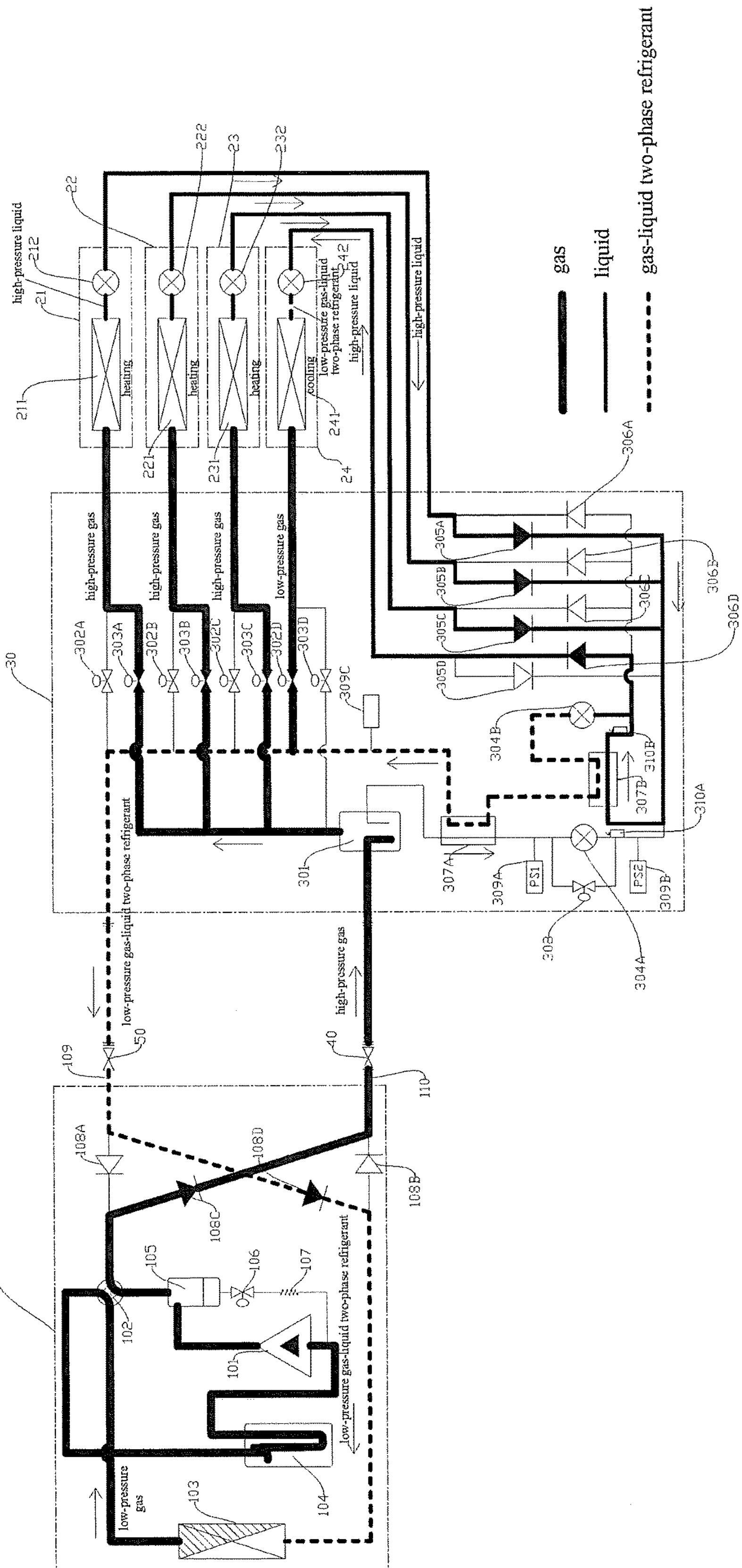

gas
liquid
gas-liquid two-phase refrigerant
high-pressure liquid
heating
high-pressure gas
low-pressure gas-liquid two-phase refrigerant
low-pressure gas
10
30
21
211
212
22
221
222
23
231
232
24
241
242
301
302A
302B
302C
302D
303A
303B
303C
303D
304A
304B
305A
305B
305C
305D
306A
306B
306C
306D
307A
307B
308
309A
309B
309C
310A
310B
PS1
PS2
40
50
101
102
103
104
105
106
107
108A
108B
108C
108D
109
110

Fig. 2


gas
liquid
gas-liquid two-phase refrigerant
high-pressure liquid
heating
heating
heating
cooling
low-pressure gas-liquid two-phase refrigerant
high-pressure liquid
high-pressure liquid
high-pressure gas
high-pressure gas
high-pressure gas
low-pressure gas
low-pressure gas-liquid two-phase refrigerant
high-pressure gas
low-pressure gas-liquid two-phase refrigerant
low-pressure gas
high-pressure gas-liquid two-phase refrigerant
10
101
102
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104
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106
107
108A
108B
108C
108D
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110
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301
302A
302B
302C
302D
303
303A
303B
303C
303D
304A
304B
305A
305B
305C
305D
306A
306B
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307A
307B
309A
309B
309C
310A
310B
PS1
PS2
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211
212
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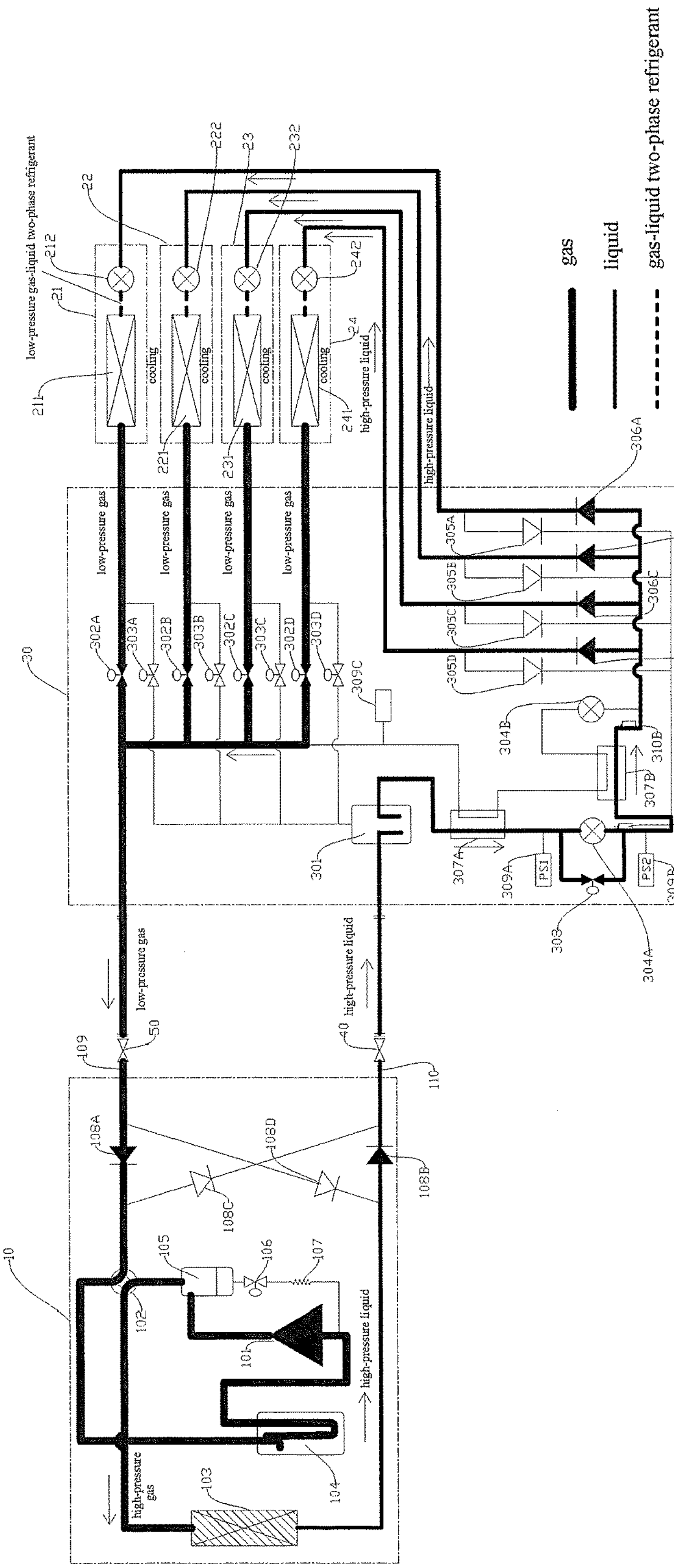
231
232
24
241
242

Fig. 3


low-pressure gas-liquid two-phase refrigerant
cooling
high-pressure liquid
low-pressure gas
high-pressure gas
gas
liquid
gas-liquid two-phase refrigerant
PS1
PS2
10
30
21
22
23
24
211
212
221
222
231
232
241
242
301
302A
302B
302C
302D
303A
303B
303C
303D
304A
304B
305A
305B
305C
305D
306A
306B
306C
306D
307A
307B
308
309A
309B
309C
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108A
108B
108C
108D
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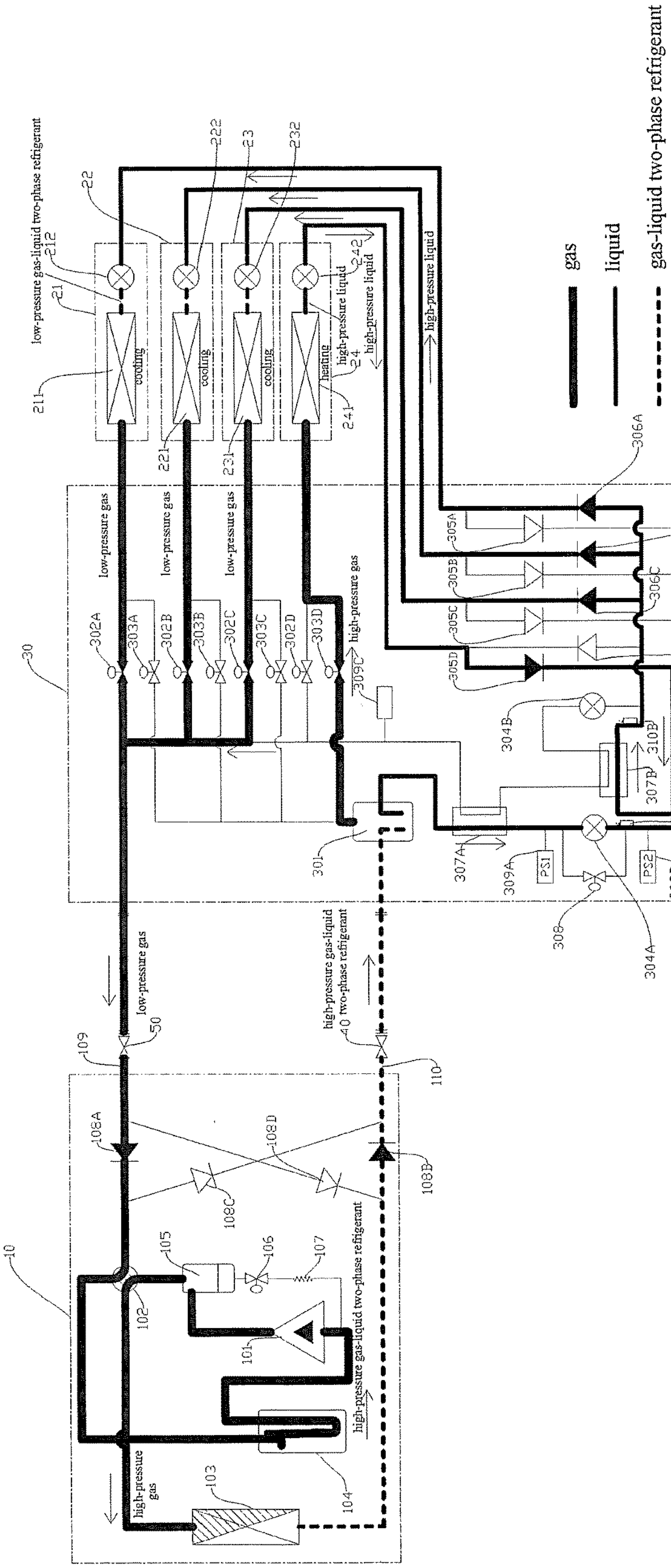
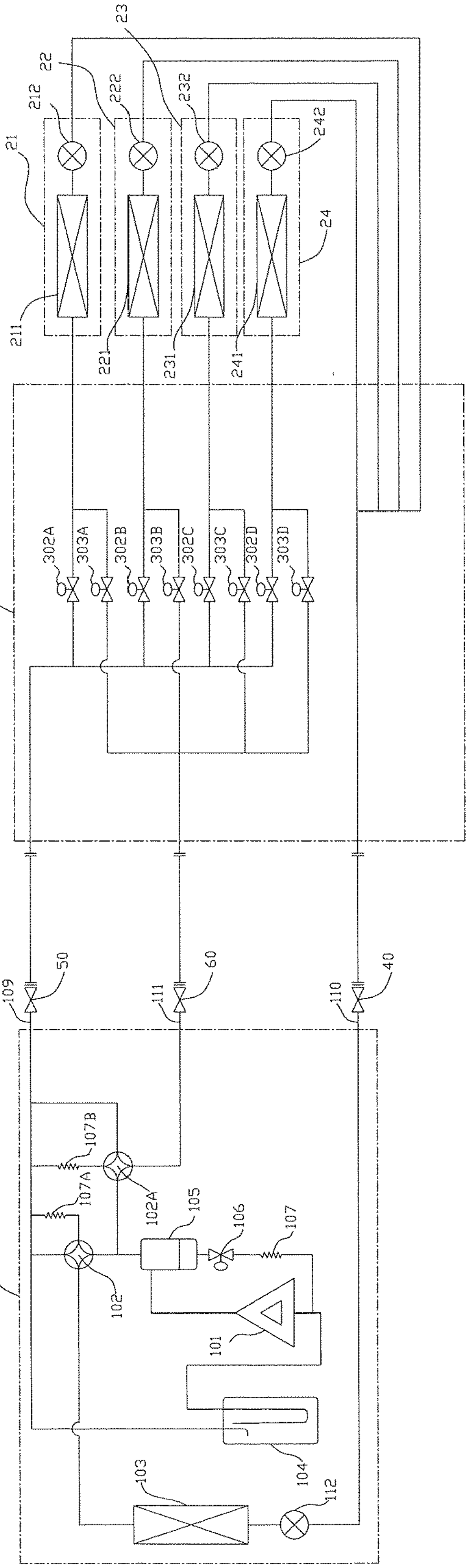
Fig. 4



10
101
102
103
104
105
106
107
108A
108B
108C
108D
109
110
high-pressure gas
high-pressure gas-liquid two-phase refrigerant
50
low-pressure gas
40
high-pressure gas-liquid two-phase refrigerant
30
301
302A
302B
302C
302D
303A
303B
303C
303D
304A
304B
305A
305B
305C
305D
306A
306B
306C
306D
307A
307B
308
309A
309B
309C
310A
310B
PS1
PS2
low-pressure gas
high-pressure gas
high-pressure liquid
21
211
212
22
221
222
23
231
232
24
241
242
cooling
heating
low-pressure gas-liquid two-phase refrigerant
gas
liquid
gas-liquid two-phase refrigerant

Fig. 5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102A
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104
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107A
107B
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111
112
50
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30
302A
303A
302B
303B
302C
303C
302D
303D
21
211
212
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222
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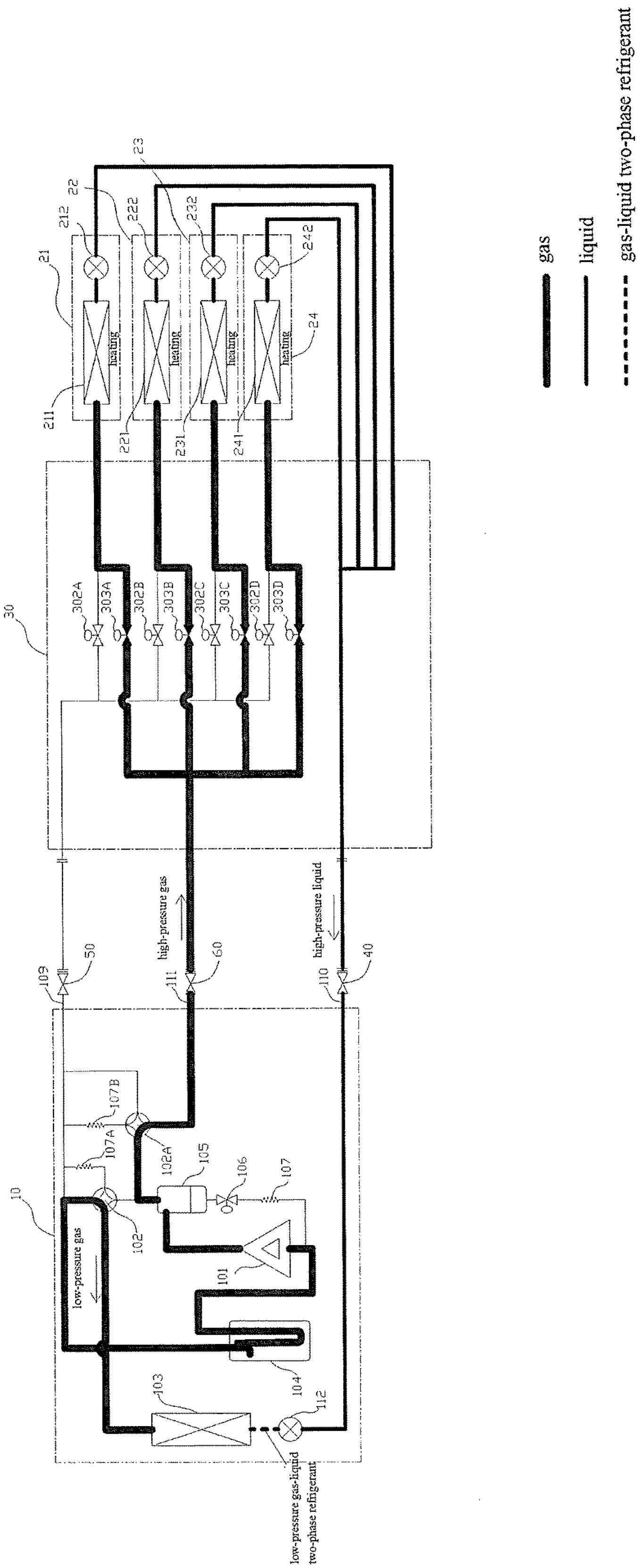
Fig. 6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211
212
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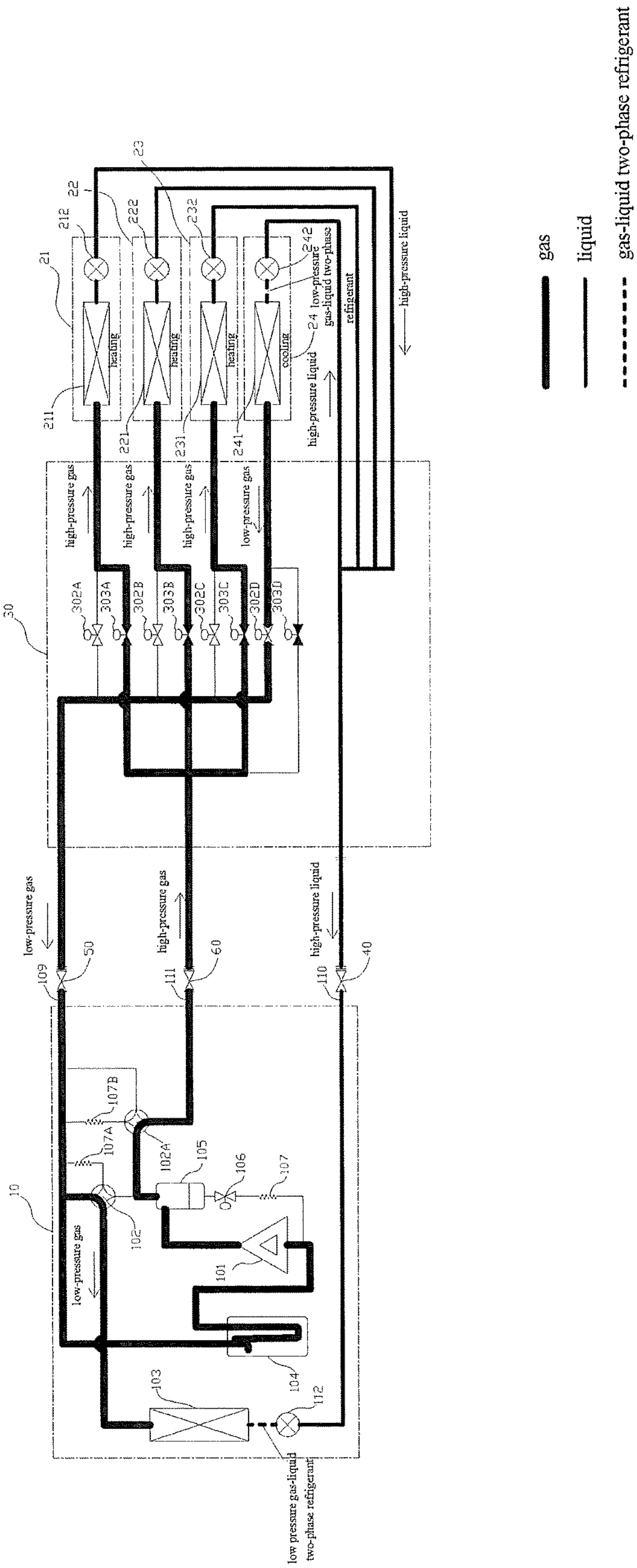
221
222
23
231
232
24
241
242
heating
heating
heating
heating
30
302A
303A
302B
303B
302C
303C
302D
303D
50
109
60
111
high-pressure gas
40
110
high-pressure liquid
10
low-pressure gas
102
102A
107A
107B
105
106
107
101
104
103
112
low-pressure gas-liquid
two-phase refrigerant
gas
liquid
gas-liquid two-phase refrigerant

Fig. 7


gas
liquid
gas-liquid two-phase refrigerant
21
211
212
22
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222
23
231
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24
241
242
heating
heating
heating
cooling
low-pressure gas-liquid two-phase refrigerant
high-pressure liquid
high-pressure liquid
30
302A
303A
302B
303B
302C
303C
302D
303D
high-pressure gas
high-pressure gas
high-pressure gas
low-pressure gas
low-pressure gas
high-pressure gas
high-pressure liquid
50
60
40
109
111
110
10
107B
107A
102A
105
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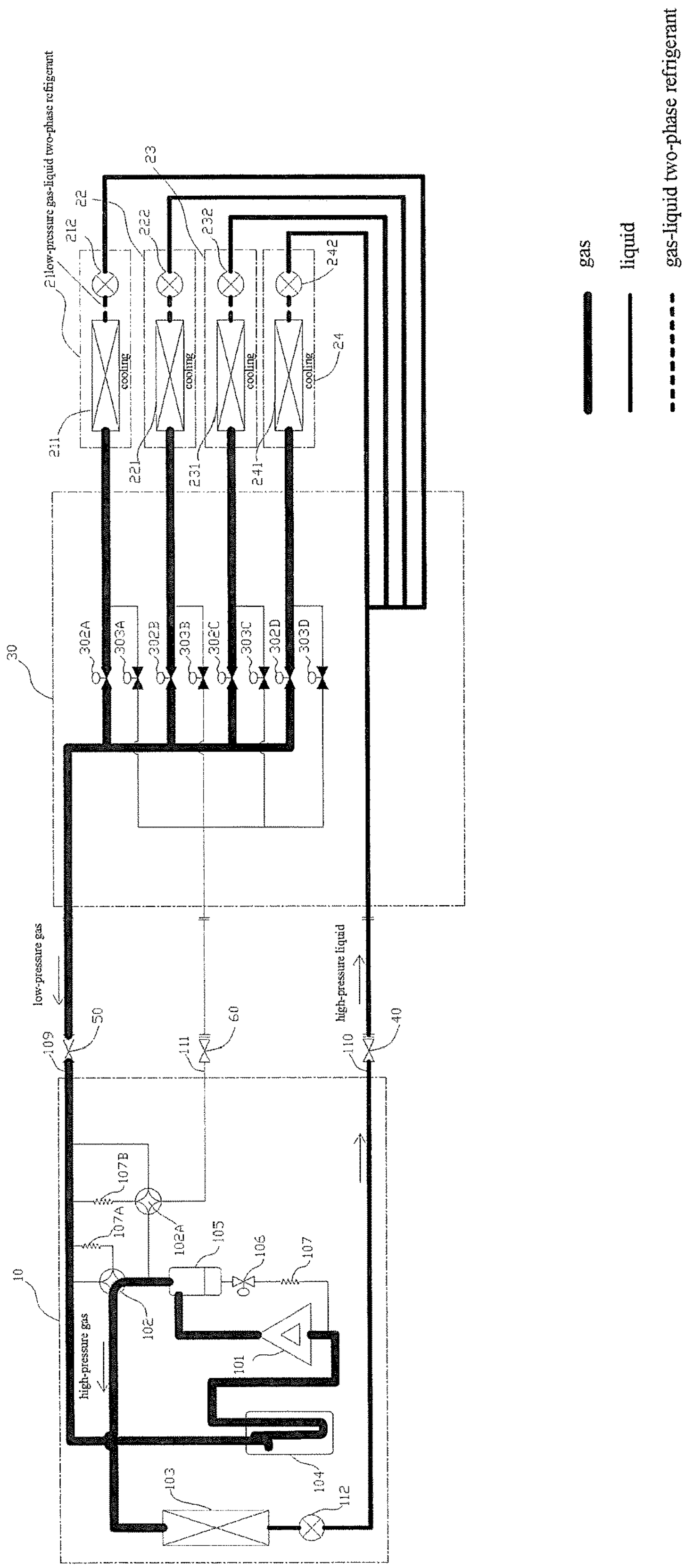
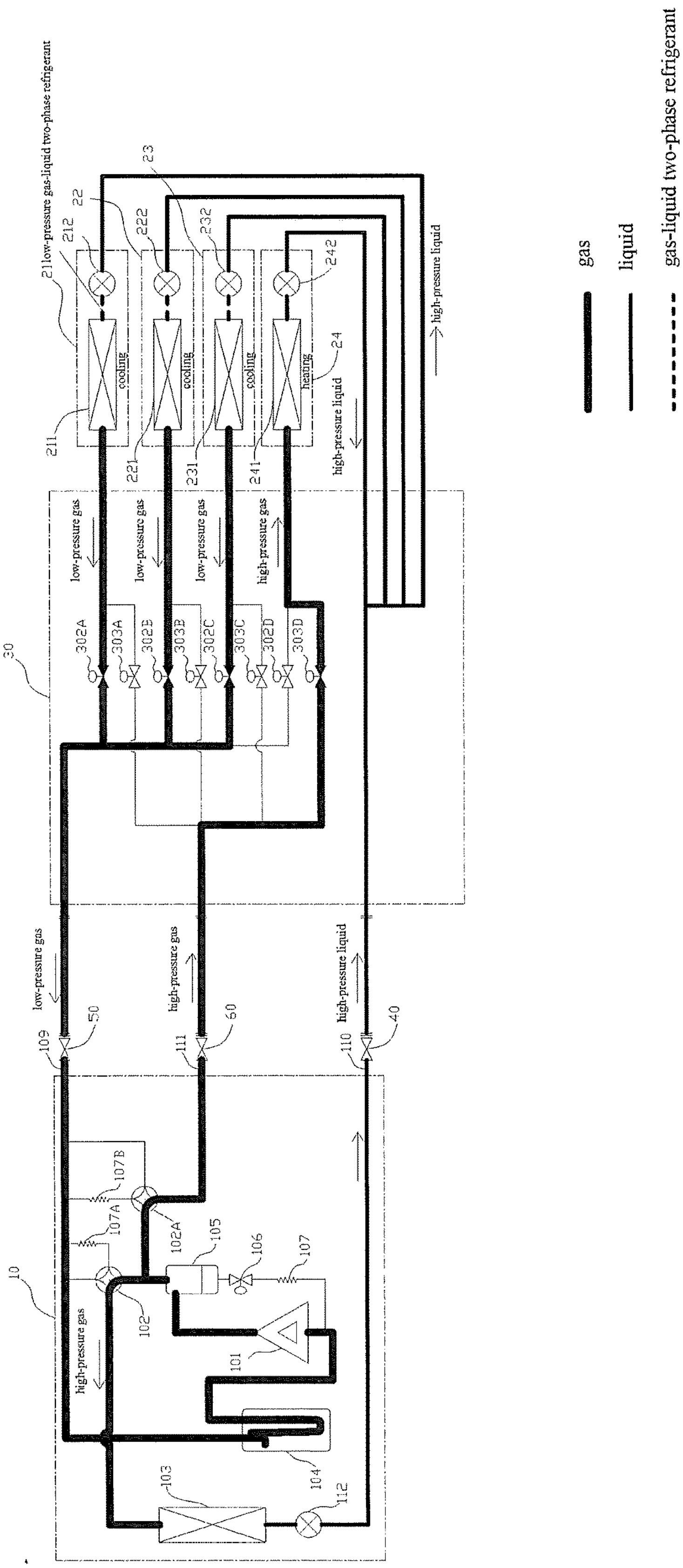
107
102
101
low-pressure gas
104
103
112
low pressure gas-liquid two-phase refrigerant

Fig. 8



21 low-pressure gas-liquid two-phase refrigerant
212
22
222
23
232
242
211
221
231
241
24
cooling
cooling
cooling
cooling
gas
liquid
gas-liquid two-phase refrigerant
30
302A
303A
302B
303B
302C
303C
302D
303D
low-pressure gas
high-pressure liquid
50
60
40
109
111
110
10
107B
107A
102A
105
106
107
high-pressure gas
102
101
104
103
112

Fig. 9


gas
liquid
gas-liquid two-phase refrigerant
21 low-pressure gas-liquid two-phase refrigerant
high-pressure liquid
cooling
cooling
cooling
heating
low-pressure gas
low-pressure gas
low-pressure gas
high-pressure gas
high-pressure liquid
low-pressure gas
high-pressure gas
high-pressure liquid
high-pressure gas
211
212
22
221
222
23
231
232
24
241
242
30
302A
303A
302B
303B
302C
303C
302D
303D
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101
102
102A
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107A
107B
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111
112
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60

Fig. 10

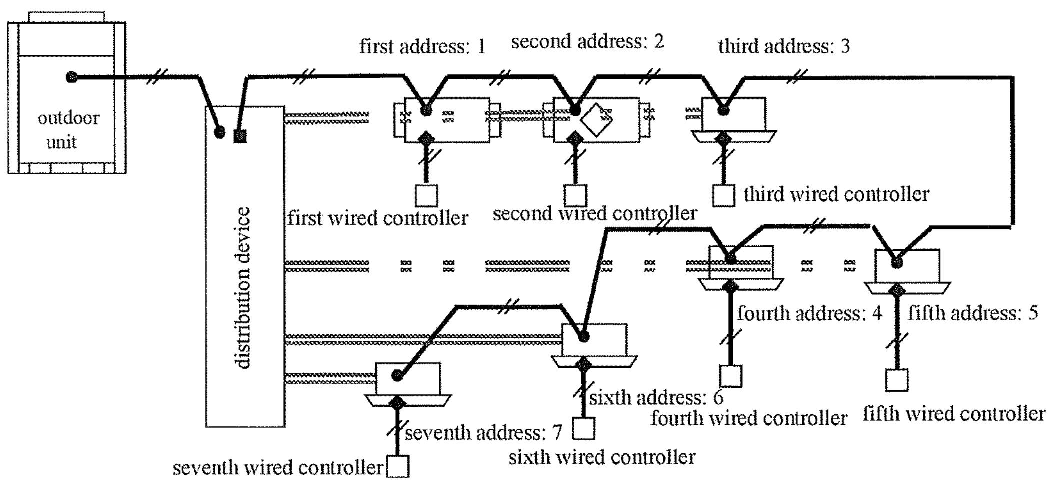
first address: 1
second address: 2
third address: 3
outdoor unit
distribution device
first wired controller
second wired controller
third wired controller
fourth address: 4
fifth address: 5
sixth address: 6
fourth wired controller
fifth wired controller
seventh address: 7
sixth wired controller
seventh wired controller

Fig. 11

VARIABLE REFRIGERANT FLOW SYSTEM

FIELD

[0001] The present disclosure relates to air conditioning field, and more particularly, to a multi-split system.

BACKGROUND

[0002] With the development of society, the requirements for the air conditioning technology are raised correspondingly, for example, multi-split products are required to realize a simultaneous cooling and heating. Therefore, a heat recovery multi-split system is increasingly popular in the market.

[0003] Currently, there are a two-pipe heat recovery multi-split system and a three-pipe heat recovery multi-split system in the multi-split air conditioner market. The two-pipe heat recovery multi-split system and the three-pipe heat recovery multi-split system correspond to different refrigerant switching devices respectively, usually an unloading valve is opened before switching the operating mode, and the unloading valve is closed after switching the operating mode. However, because the pressure difference between two ends of the unloading valve is large, the bypass noise is big, such that the noise during the mode switching of the indoor unit is too big, which impacts the comfort level of users.

SUMMARY

[0004] Therefore, an objective of the present disclosure is to provide a multi-split system, which may effectively reduce noise generated when the indoor unit switches the mode, and improves the comfort level of users.

[0005] To achieve the above objective, embodiments of the present disclosure provides a multi-split system, including an outdoor unit, a distribution device, a plurality of indoor units, in which each indoor unit includes an indoor heat exchanger and a throttling element, and the distribution device includes a plurality of first controlling valves and a plurality of second controlling valves corresponding to each indoor unit. When any one of the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to the distribution device; the distribution device determines on or off statuses of a first on/off valve and a second on/off valve corresponding to the indoor unit according to the mode switching instruction.

[0006] By the multi-split system according to embodiments of the present disclosure, when any one of the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to a distribution device such that the distribution device determines the on or off statuses of the first on/off valve and the second on/off valve corresponding to the indoor unit according to the mode switching instruction so as to ensure a small pressure difference between the front and back of the on/off valve when the indoor unit switches the mode, and thus noises generated due to a big pressure difference in the mode switching process may be effectively reduced, and the comfort level of users may be improved.

[0007] According to an embodiment of the present disclosure, when any one of the plurality of indoor units is under a heating operating mode, the distribution device controls the second on/off valve corresponding to the indoor unit to open, and controls the first on/off valve corresponding to the indoor unit to close, and controls an opening of the throttling element in the indoor unit by an indoor controller in the indoor unit, in which when the indoor unit receives an instruction indicating switching to a cooling operating mode, the distribution device controls the second on/off valve corresponding to the indoor unit to close, and controls the throttling element in the indoor unit to reach a standby opening by an indoor controller in the indoor unit; controls the throttling element in the indoor unit to reach a maximum opening by the indoor controller in the indoor unit after a first preset time so as to make the indoor unit be filled with a medium-pressure liquid refrigerant, the distribution device controls the first on/off valve corresponding to the indoor unit to open after a second preset time, in which the second preset time is longer than the first preset time.

[0008] According to another embodiment of the present disclosure, when any one of the plurality of indoor units is under a cooling operating mode, the distribution device controls the first on/off valve corresponding to the indoor unit to open, and controls the second on/off valve corresponding to the indoor unit to close, and controls an opening of the throttling element in the indoor unit by an indoor controller in the indoor unit, in which when the indoor unit receives an instruction indicating switching to a heating operating mode, the distribution device controls the first on/off valve corresponding to the indoor unit to close, and controls the throttling element in the indoor unit to reach a maximum opening by the indoor controller in the indoor unit; the distribution device controls the second on/off valve corresponding to the indoor unit to open after a second preset time.

[0009] In embodiments of the present disclosure, the multi-split system includes a two-pipe heat recovery multi-split system and a three-pipe heat recovery multi-split system.

[0010] In embodiments of the present disclosure, when any one of the plurality of indoor units is under a cooling operating mode, the indoor unit may be controlled to be switched to a cooling standby mode, a cooling stopping mode or a heating operating mode; when any one of the plurality of indoor units is under a cooling standby mode, the indoor unit may be controlled to be switched to a cooling stopping mode or a heating operating mode; when any one of the plurality of indoor units is under a cooling stopping mode, the indoor unit may be controlled to be switched to a cooling operating mode or a heating operating mode; when any one of the plurality of indoor units is under a heating operating mode, the indoor unit may be controlled to be switched to a heating standby mode, a heating stopping mode or a cooling operating mode; when any one of the plurality of indoor units is under a heating standby mode, the indoor unit may be controlled to be switched to a heating stopping mode or a cooling operating mode; when any one of the plurality of indoor units is under a heating stopping mode, the indoor unit may be controlled to be switched to a cooling operating mode or a heating operating mode.

[0011] In an embodiment, the first preset time may be in a range of 20 to 40 seconds, and the second preset time may be in a range of 50 to 70 seconds.

[0012] In an embodiment, the standby opening may be 72 P, and the maximum opening may be 480 P.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** is a schematic view of a two-pipe multi-split system according to an embodiment of the present disclosure;

[0014] FIG. **2** is a schematic view of a two-pipe multi-split system operating under a pure heating mode according to an embodiment of the present disclosure;

[0015] FIG. **3** is a schematic view of a two-pipe multi-split system operating under a main heating mode according to an embodiment of the present disclosure;

[0016] FIG. **4** is a schematic view of a two-pipe multi-split system operating under a pure cooling mode according to an embodiment of the present disclosure;

[0017] FIG. **5** is a schematic view of a two-pipe multi-split system operating under a main cooling mode according to an embodiment of the present disclosure;

[0018] FIG. **6** is a schematic view of a three-pipe multi-split system according to another embodiment of the present disclosure;

[0019] FIG. **7** is a schematic view of a three-pipe multi-split system operating under a pure heating mode according to another embodiment of the present disclosure;

[0020] FIG. **8** is a schematic view of a three-pipe multi-split system operating under a main heating mode according to another embodiment of the present disclosure;

[0021] FIG. **9** is a schematic view of a three-pipe multi-split system operating under a pure cooling mode according to another embodiment of the present disclosure;

[0022] FIG. **10** is a schematic view of a three-pipe multi-split system operating under a main cooling mode according to another embodiment of the present disclosure; and

[0023] FIG. **11** is a communication network diagram of a multi-split system according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0024] Embodiments of the present disclosure will be described in detail in the following descriptions, examples of which are shown in the accompanying drawings, in which the same or similar elements and elements having same or similar functions are denoted by like reference numerals throughout the descriptions. The embodiments described herein with reference to the accompanying drawings are exemplary, which are used to explain the present disclosure, and shall not be construed to limit the present disclosure.

[0025] A multi-split system according to embodiments of the present disclosure will be described below by referring to the accompanying drawings.

[0026] In embodiments of the present disclosure, as shown in FIG. **1** to FIG. **10**, the multi-split system includes an outdoor unit **10**, a distribution device **30** and a plurality of indoor units (such as four indoor units **21**, **22**, **23**, **24**).

[0027] Each indoor unit includes an indoor heat exchanger and a throttling element, the distribution device **30** includes a plurality of first controlling valves and a plurality of second controlling valves corresponding to each indoor unit. When any one of the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to the distribution device **30** such that the distribution device **30** determines on or off statuses of the first on/off valve and the second on/off valve corresponding to the indoor unit according to the mode switching instruction.

[0028] In embodiments of the present disclosure, the multi-split system may include a two-pipe heat recovery multi-split system and a three-pipe heat recovery multi-split system.

[0029] In the two-pipe heat recovery multi-split system according to embodiments of the present disclosure, as shown in FIG. **1** to FIG. **5**, the outdoor unit **10** includes a compressor **101**, a four-way valve **102**, an outdoor heat exchanger **103**, an outdoor gas-liquid separator **104**, an oil separator **105**, a first electromagnetic valve **106**, a capillary **107**, four one-way valves **108**A, **108**B, **108**C, **108**D, a first interface **109** and a second interface **110**. The compressor **101** has an exhaust port and a gas returning port, and the four-way valve **102** has a first valve port to a fourth valve port, in which the first valve port is communicated with one of the second valve port and the third valve port, and the fourth valve port is communicated with the other one of the second valve port and the third valve port, and the first valve port is communicated with the exhaust port of the compressor **101** through the oil separator **105**, and the fourth valve port is communicated with the gas returning port of the compressor **101** through the outdoor gas-liquid separator **104**, and the one-way valve **108**A is connected in series between the second valve port and the first interface **109**, and the third valve port is connected to a first end of the outdoor heat exchanger **103**.

[0030] The distribution device **30** includes a gas-liquid separator **301**, a plurality of first controlling valves (such as four first controlling valves **302**A, **302**B, **302**C, **302**D), a plurality of second controlling valves (such as four second controlling valves **303**A, **303**B, **303**C, **303**D), a first electronic expansion valve **304**A, a second electronic expansion valve **304**B, four first one-way valves **305**A, **305**B, **305**C, **305**D, four second one-way valves **306**A, **306**B, **306**C, **306**D, a first heat exchange assembly **307**A and a second heat exchange assembly **307**B. The gas-liquid separator **301** has an inlet, a gas outlet and a liquid outlet, the inlet is connected to a second end of the outdoor heat exchanger **103** through a high-pressure stop valve **40** and the one-way valve **108**B, the gas outlet is connected to the four second controlling valves **303**A, **303**B, **303**C, **303**D respectively; the four first controlling valves **302**A, **302**B, **302**C, **302**D are connected to the first interface **109** through the low-pressure stop valve **50** respectively. The first heat exchange assembly **307**A and the second heat exchange assembly **307**B may be plate heat exchangers, and may also be double-pipe heat exchangers.

[0031] As shown in FIG. **1** to FIG. **5**, the first end of the one-way valve **108**A is connected between the one-way valve **108**B and the second interface **110** through the one-way valve **108**C, and the second end of the one-way valve **108**A is connected between the one-way valve **108**B and the outdoor heat exchanger **103** through the one-way valve **108**D.

[0032] The first heat exchange assembly **307**A and the second heat exchange assembly **307**B each have a first heat exchange flow path and a second heat exchange flow path, and the liquid outlet of the gas-liquid separator **301** is connected to the first heat exchange flow path of the first heat exchange assembly **307**A, and the first heat exchange flow path of the first heat exchange assembly **307**A is connected to the first electronic expansion valve **304**A, and the second heat exchange flow path of the first heat exchange assembly **307**A is connected to the second heat exchange flow path of the second heat exchange assembly **307**B and the four first controlling valves **302**A, **302**B, **302**C, **302**D respectively.

[0033] As shown in FIG. **1** to FIG. **5**, each indoor unit includes an indoor heat exchanger and a throttling element. The indoor unit **21** includes an indoor heat exchanger **211** and a throttling element **212**, and the indoor unit **22** includes an indoor heat exchanger **221** and a throttling element **222**, and the indoor unit **23** includes an indoor heat exchanger **231** and a throttling element **232**, and the indoor unit **24** includes an indoor heat exchanger **241** and a throttling element **242**. The first end of the indoor heat exchanger in each indoor unit is connected to the corresponding throttling element, the second end of the indoor heat exchanger in each indoor unit is connected to the corresponding first controlling valve and second controlling valve, and the throttling element in each indoor unit is connected to the corresponding first one-way valve and the second one-way valve, and the flow direction of the first one-way valve is opposite to the flow direction of the second one-way valve. Moreover, the four first one-way valves **305**A, **305**B, **305**C, **305**D are all connected to a first common flow path, and the four second one-way valves **306**A, **306**B, **306**C, **306**D are all connected to a second common flow path, and the first heat exchange flow path of the second heat exchange assembly **307**B is communicated with the first common flow path and the second common flow path respectively, and the first electronic expansion valve **304**A is connected to the first common flow path, and the second electronic expansion valve **304**B is connected to the second heat exchange flow path of the second heat exchange assembly **307**B and the second common flow path respectively, and the first electronic expansion valve **304**A is further connected with the second electromagnetic valve **308** in parallel.

[0034] As shown in FIG. **1** to FIG. **5**, a pressure sensor **309**A and a pressure sensor **309**B are provided at two ends of the first electronic expansion valve **304**A and the second electromagnetic valve **308** in parallel connection respectively, and a temperature sensor **310**A and a temperature sensor **310**B are provided at two ends of the first heat exchange flow path of the second heat exchange assembly **307**B respectively. In addition, a pressure sensor **309**C is provided at one end of the second heat exchange flow path of the first heat exchange assembly **307**A.

[0035] In the three-pipe heat recovery multi-split system according to embodiments of the present disclosure, as shown in FIG. **6** to FIG. **10**, the outdoor unit **10** includes a compressor **101**, two four-way valves **102**, **102**A, an outdoor heat exchanger **103**, an outdoor gas-liquid separator **104**, an oil separator **105**, a first electromagnetic valve **106**, three capillaries **107**, **107**A, **107**B, an electronic expansion valve **112**, and a first interface **109**, a second interface **110** and a third interface **111**. The compressor **101** has an exhaust port and a gas returning port, and the two four-way valves **102**, **102**A each have a first valve port to a fourth valve port, in which the first valve port is communicated with one of the second valve port and the third valve port, and the fourth valve port is communicated with the other one of the second valve port and the third valve port, in which the first valve port of the four-way valve **102** is connected to the exhaust port of the compressor **101** through the oil separator **105**, and the fourth valve port is connected to the gas returning port of the compressor **101** through the outdoor gas-liquid separator **104**, and a capillary **107**A is connected in parallel between the second valve port and the fourth valve port, and the third valve port is connected to a first end of the outdoor heat exchanger **103**. The first valve port of the four-way valve **102**A is connected to the third interface **111**, the second valve port is connected to the first end of the outdoor heat exchanger **103** directly, and the third valve port is connected to the exhaust port of the compressor **101** through the oil separator **105**, and the fourth valve port is connected to the first end of the outdoor heat exchanger **103** through the capillary **107**B.

[0036] The distribution device **30** includes a plurality of first controlling valves (such as four first controlling valves **302**A, **302**B, **302**C, **302**D) and a plurality of second controlling valves (such as four second controlling valves **303**A, **303**B, **303**C, **303**D). The four first controlling valves **302**A, **302**B, **302**C, **302**D are connected to the first interface **109** through the low-pressure stop valve **50** respectively, and the four second controlling valves **303**A, **303**B, **303**C, **303**D are connected to the third interface **111** through the stop valve **60** respectively.

[0037] As shown in FIG. **6** to FIG. **10**, each indoor unit includes an indoor heat exchanger and a throttling element, in which the indoor unit **21** includes an indoor heat exchanger **211** and a throttling element **212**, and the indoor unit **22** includes an indoor heat exchanger **221** and a throttling element **222**, and the indoor unit **23** includes an indoor heat exchanger **231** and a throttling element **232**, and the indoor unit **24** includes an indoor heat exchanger **241** and a throttling element **242**. The first end of the indoor heat exchanger in each indoor unit is connected to the corresponding throttling element, and the second end of the indoor heat exchanger in each indoor unit is connected to the corresponding first controlling valve and second controlling valve, and the throttling element in each indoor unit is connected to the second interface **110** through the high-pressure stop valve **40**.

[0038] According to an embodiment of the present disclosure, when any one of the plurality of indoor units is under a heating operating mode, the distribution device **30** controls the second on/off valve corresponding to the indoor unit to open, and controls the first on/off valve corresponding to the indoor unit to close, and controls the opening of the throttling element in the indoor unit by an indoor controller in the indoor unit, in which when the indoor unit receives an instruction indicating switching to a cooling operating mode, the distribution device **30** controls the second on/off valve corresponding to the indoor unit to close, and controls the throttling element in the indoor unit to reach a standby opening by an indoor controller in the indoor unit; controls the throttling element in the indoor unit to reach an maximum opening by the indoor controller in the indoor unit after a first preset time so as to make the indoor unit be filled with a medium-pressure liquid refrigerant, the distribution device **30** controls the first on/off valve corresponding to the indoor unit to open after a second preset time to complete a switch to a cooling operating mode from a heating operating mode, which makes the pressure difference between the front and back of the first on/off valve equivalent to a switch between a medium pressure and a low pressure, such that the pressure difference during the mode switching is small, and noise during the mode switching of the indoor unit is reduced. The second preset time is longer than the first preset time.

[0039] In an embodiment, the first preset time may be in a range of 20 to 40 seconds, and the second preset time may be in a range of 50 to 70 seconds.

[0040] In an embodiment, the standby opening may be 72 P, and the maximum opening may be 480 P.

[0041] According to another embodiment of the present disclosure, when any one of the plurality of indoor units is under a cooling operating mode, the distribution device **30** controls the first on/off valve corresponding to the indoor unit to open, and controls the second on/off valve corresponding to the indoor unit to close, and controls the opening of the throttling element in the indoor unit by an indoor controller in the indoor unit, in which when the indoor unit receives an instruction indicating switching to a heating operating mode, the distribution device **30** controls the first on/off valve corresponding to the indoor unit to close, and controls the throttling element in the indoor unit to reach a maximum opening by the indoor controller in the indoor unit; the distribution device **30** controls the second on/off valve corresponding to the indoor unit to open after a second preset time to complete a switch to a heating operating mode from a cooling operating mode, which makes the pressure difference between the front and back of the second on/off valve equivalent to a switch between a high pressure and a medium pressure, such that the pressure difference during the mode switching is small, and the noise during the mode switching of the indoor unit is reduced.

[0042] In embodiments of the present disclosure, the operating mode of the multi-split system includes a pure cooling mode, a pure heating mode and a simultaneous cooling and heating mode, in which the simultaneous cooling and heating mode includes a main cooling mode and a main heating mode.

[0043] Next, flow directions of refrigerants when the two-pipe multi-split system works under a pure heating mode, a main heating mode, a pure cooling mode and a main cooling mode will be described respectively by referring to FIG. **2** to FIG. **5**.

[0044] As shown in FIG. **2**, when the outdoor unit **10** determines that the multi-split system works under a pure heating mode, the four indoor units perform heating work. The flow direction of a refrigerant will be described as follows: a high-pressure gas flows into the four-way valve **102** through the oil separator **105** from the exhaust port of the compressor **101**, then flows into the gas-liquid separator **301** via the one-way valve **108**C, the second interface **110** and the high-pressure stop valve **40**, and the high-pressure gas flows into the corresponding four indoor heat exchangers via the four second controlling valves **303**A, **303**B, **303**C, **303**D respectively from the gas outlet of the gas-liquid separator **301**, and then turns into a high-pressure liquid; then, the four-way high-pressure liquid flows into the first heat exchange flow path of the second heat exchange assembly **307**B via the corresponding throttling elements and the four first one-way valves **305**A, **305**B, **305**C, **305**D, and turns into a low-pressure gas-liquid two-phase refrigerant via the second electronic expansion valve **304**B; the low-pressure gas-liquid two-phase refrigerant flows back to the outdoor unit **10** via the second heat exchange flow path of the second heat exchange assembly **307**B and the second heat exchange flow path of the first heat exchange assembly **307**A, that is, the low-pressure gas-liquid two-phase refrigerant turns into a low-pressure gas after flowing back to the outdoor heat exchanger **103** via the low-pressure stop valve **50**, the first interface **109** and the one-way valve **108**D, and the low-pressure gas flows back to the gas returning port of the compressor **101** via the four-way valve **102** and the outdoor gas-liquid separator **104**.

[0045] As shown in FIG. **3**, when the outdoor unit **10** determines that the multi-split system works under a main heating mode, three of the four indoor units perform heating work, and one indoor unit performs cooling work. The flow direction of a refrigerant for heating will be described as follows: a high-pressure gas flows into the four-way valve **102** through the oil separator **105** from the exhaust port of the compressor **101**, then flows into the gas-liquid separator **301** via the one-way valve **108**C, the second interface **110** and the high-pressure stop valve **40**, and the high-pressure gas flows into the indoor heat exchangers in the corresponding three heating indoor units via the three second controlling valves **303**A, **303**B, **303**C respectively from the gas outlet of the gas-liquid separator **301**, then turns into a high-pressure liquid, and then the three-way high-pressure liquid flows into the first heat exchange flow path of the second heat exchange assembly **307**B via the corresponding throttling elements and the three first one-way valves **305**A, **305**B, **305**C, and turns into a low-pressure gas-liquid two-phase refrigerant via the second electronic expansion valve **304**B, and the low-pressure gas-liquid two-phase refrigerant flows back to the outdoor unit **10** via the second heat exchange flow path of the second heat exchange assembly **307**B and the second heat exchange flow path of the first heat exchange assembly **307**A, that is, the low-pressure gas-liquid two-phase refrigerant turns into a low-pressure gas after flowing back to the outdoor heat exchanger **103** via the low-pressure stop valve **50**, the first interface **109** and the one-way valve **108**D, and the low-pressure gas flows back to the gas returning port of the compressor **101** via the four-way valve **102** and the outdoor gas-liquid separator **104**. The flow direction of a refrigerant for cooling will be described as follows: a part of the high-pressure liquid flowing through the first heat exchange flow path of the second heat exchange assembly **307**B further turns into a low-pressure gas-liquid two-phase refrigerant after flowing into the throttling element **242** in the indoor unit **24** via the second one-way valve **306**D, then turns into a low-pressure gas via the indoor heat exchanger **241** in the indoor unit **24**; after flowing through the first controlling valve **302**D, the low-pressure gas flows back to the outdoor unit **10** after being mixed with the low-pressure gas-liquid two-phase refrigerant flowing through the second heat exchange flow path of the second heat exchange assembly **307**B and the second heat exchange flow path of the first heat exchange assembly **307**A.

[0046] As shown in FIG. **4**, when the outdoor unit **10** determines that the multi-split system works under a pure cooling mode, the four indoor units perform cooling work. The flow direction of a refrigerant will be described as follows: a high-pressure gas flows into the four-way valve **102** through the oil separator **105** from the exhaust port of the compressor **101**, then turns into a high-pressure liquid after flowing through the outdoor heat exchanger **103**, and the high-pressure liquid flows into the gas-liquid separator **301** via the one-way valve **108**B, the second interface **110** and the high-pressure stop valve **40**, and the high-pressure liquid flows into the first electronic expansion valve **304**A and the second electromagnetic valve **308** via the first heat exchange flow path of the first heat exchange assembly **307**A from the liquid outlet of the gas-liquid separator **301**, then flows into the four second one-way valves **306**A, **306**B, **306**C, **306**D respectively via the first heat exchange flow path of the second heat exchange assembly **307**B, and the four-way high-pressure liquid flowing through the four second one-way valves **306**A, **306**B, **306**C, **306**D turns into a four-way low-pressure gas-liquid two-phase refrigerant after correspondingly flowing through the throttling elements in the four indoor units respectively, and the four-way low-pressure gas-liquid two-phase refrigerant turns into a four-way low-pressure gas after flowing through the corresponding indoor heat exchangers respectively, and then the low-pressure gas flows back to the outdoor unit **10** correspondingly via the four first controlling valves **302**A, **302**B, **302**C, **302**D, that is, the low-pressure gas flows back to the gas returning port of the compressor **101** via the low-pressure stop valve **50**, the first interface **109**, the one-way valve **108**A and the outdoor gas-liquid separator **104**.

[0047] As shown in FIG. **5**, when the outdoor unit **10** determines that the multi-split system works under a main cooling mode, three of the four indoor units perform cooling works and one indoor unit performs heating work. The flow direction of a refrigerant for cooling will be described as follows: a high-pressure gas flows into the four-way valve **102** through the oil separator **105** from the exhaust port of the compressor **101**, then turns into a high-pressure gas-liquid two-phase refrigerant after flowing through the outdoor heat exchanger **103**, and the high-pressure gas-liquid two-phase refrigerant flows into the gas-liquid separator **301** via the one-way valve **108**B, the second interface **110** and the high-pressure stop valve **40** to perform a gas-liquid separation, in which the high-pressure liquid flows into the first electronic expansion valve **304**A and the second electromagnetic valve **308** via the first heat exchange flow path of the first heat exchange assembly **307**A from the liquid outlet of the gas-liquid separator **301**, then flows into the three second one-way valves **306**A, **306**B, **306**C via the first heat exchange flow path of the second heat exchange assembly **307**B respectively, the three-way high-pressure liquid flowing through the three second one-way valves **306**A, **306**B, **306**C turns into a three-way low-pressure gas-liquid two-phase refrigerant after correspondingly flowing through throttling elements in the three indoor units respectively, and the three-way low-pressure gas-liquid two-phase refrigerant turns into three-way low-pressure gas after flowing through the corresponding indoor heat exchangers respectively, then flows back to the outdoor unit **10** correspondingly via the three first controlling valves **302**A, **302**B, **302**C, that is, the low-pressure gas flows back to the gas returning port of the compressor **101** via the low-pressure stop valve **50**, the first interface **109**, the one-way valve **108**A, and the outdoor gas-liquid separator **104**. The flow direction of a refrigerant for heating will be described as follows: a high-pressure gas after the gas-liquid separation through the gas-liquid separator **301** flows into the indoor heat exchanger **241** in the indoor unit **24** via the second controlling valve **303**D from the gas outlet of the gas-liquid separator **301**, then turns into a high-pressure liquid; and after flowing through the throttling element **242** in the indoor unit **24**, the high-pressure liquid joins the high-pressure liquid flowing through the first heat exchange flow path of the second heat exchange assembly **307**B via the first one-way valve **305**D.

[0048] Next, flow directions of the refrigerants when the three-pipe multi-split system works under a pure heating mode, a main heating mode, a pure cooling mode and a main cooling mode will be described respectively by referring to FIG. **7** to FIG. **10**.

[0049] As shown in FIG. **7**, when the outdoor unit **10** determines that the multi-split system works under a pure heating mode, the four indoor units perform heating work. The flow direction of a refrigerant will be described as follows: a high-pressure gas flows into the four-way valve **102** via the oil separator **105** from the exhaust port of the compressor **101**A, then flows into the corresponding four indoor heat exchangers via the third interface **111**, the stop valve **60**, the four second controlling valves **303**A, **303**B, **303**C, **303**D, then turns into a high-pressure liquid, and then the four-way high-pressure liquid flows into the electronic expansion valve **112** via the corresponding throttling elements, the high-pressure stop valve **40** and the second interface **110**; and after turning into a low-pressure gas-liquid two-phase refrigerant via the electronic expansion valve **112**, the high-pressure liquid turns into a low-pressure gas after flowing through the outdoor heat exchanger **103**, and the low-pressure gas flows back to the gas returning port of the compressor **101** via the four-way valve **102** and the outdoor gas-liquid separator **104**.

[0050] As shown in FIG. **8**, when the outdoor unit **10** determines that the multi-split system works under a main heating mode, three of the four indoor units perform heating work and one indoor unit performs cooling work. The flow direction of a refrigerant for heating will be described as follows: a high-pressure gas flows into the four-way valve **102** via the oil separator **105** from the exhaust port of the compressor **101**A, then flows into the indoor heat exchangers in the corresponding three heating indoor units via the third interface **111**, the stop valve **60**, the three second controlling valves **303**A, **303**B, **303**C, then turns into a high-pressure liquid; then, after the three-way high-pressure liquid flowing through the corresponding throttling elements, a part of the high-pressure liquid flows into the electronic expansion valve **112** via the high-pressure stop valve **40** and the second interface **110**, and the high-pressure liquid turns into a low-pressure gas-liquid two-phase refrigerant via the electronic expansion valve **112**, then turns into a low-pressure gas after flowing through the outdoor heat exchanger **103**, and the low-pressure gas flows back to the gas returning port of the compressor **101** via the four-way valve **102** and the outdoor gas-liquid separator **104**. The flow direction of a refrigerant for cooling will be described as follows: the other part of the high-pressure liquid output via the throttling elements in the three heating indoor units turns into a low-pressure gas-liquid two-phase refrigerant after flowing through the throttling element **242** in the indoor unit **24**, then turns into low-pressure gas after flowing through the indoor heat exchanger **241**; and after flowing through the low-pressure stop valve **50** and the first interface **109**, the low-pressure gas join the low-pressure gas output via the four-way valve **102**.

[0051] As shown in FIG. **9**, when the outdoor unit **10** determines that the multi-split system works under a pure cooling mode, the four indoor units perform cooling work. The flow direction of a refrigerant will be described as follows: a high-pressure gas flows into the four-way valve **102** via the oil separator **105** from the exhaust port of the compressor **101**, then turns into a high-pressure liquid after flowing through the outdoor heat exchanger **103**; and after flowing through the electronic expansion valve **112**, the second interface **110** and the high-pressure stop valve **40**, the high-pressure liquid turns into a four-way low-pressure gas-liquid two-phase refrigerant after flowing through the throttling elements in the four indoor units respectively; and the four-way low-pressure gas-liquid two-phase refrigerant turns into a four-way low-pressure gas after flowing through the corresponding indoor heat exchangers respectively, and the four-way low-pressure gas flows back to the gas returning port of the compressor **101** via the four first controlling valves **302**A, **302**B, **302**C, **302**D, the low-pressure stop valve **50**, the first interface **109**, and the outdoor gas-liquid separator **104**.

[0052] As shown in FIG. **10**, when the outdoor unit **10** determines that the multi-split system works under a main cooling mode, three of the four indoor units perform cooling work and one indoor unit performs heating work. The flow direction of a refrigerant for cooling will be described as follows: after a high-pressure gas flowing through the oil separator **105** from the exhaust port of the compressor **101**, a part of the high-pressure gas flows into the four-way valve **102**, then turns into a high-pressure liquid after flowing through the outdoor heat exchanger **103**, and the high-pressure liquid flows into the throttling elements in the three indoor units via the electronic expansion valve **112**, the second interface **110** and the high-pressure stop valve **40**, and the high-pressure liquid turns into a low-pressure gas-liquid two-phase refrigerant via the throttling element, and then further turns into a three-way low-pressure gas via the indoor heat exchangers in the three indoor units, and the three-way low-pressure gas flows back to the gas returning port of the compressor **101** correspondingly via the three first controlling valves **302**A, **302**B, **302**C, the low-pressure stop valve **50**, the first interface **109** and the outdoor gas-liquid separator **104**. The flow direction of a refrigerant for heating will be described as follows: the other part of the high-pressure gas flowing through the oil separator **105** flows into the four-way valve **102**A, the third interface **111**, the stop valve **60**, the second controlling valve **303**D, then flows into the indoor heat exchanger **241** in the indoor unit **24** to turns into a high-pressure liquid; and after flowing through the throttling element **242** in the indoor unit **24**, the high-pressure liquid joins the high-pressure liquid flowing through the high-pressure stop valve **40**.

[0053] In embodiments of the present disclosure, each indoor unit needs to send an operating parameter of the indoor unit to the distribution device **30**, in which the operating parameter of each indoor unit includes: an operating mode of the indoor unit (such as a cooling mode, a heating mode, etc.), a superheat degree when the indoor unit serves as a cooling indoor unit and an opening of the throttling element when the indoor unit serves as a cooling indoor unit, etc.

[0054] According to an embodiment of the present disclosure, as shown in FIG. **11**, the outdoor unit and the distribution device may communicate with each other directly, and each indoor unit communicates with the outdoor unit through the distribution device. Each indoor unit is allocated with an address for convenience for the communications between individual indoor units and communications between each indoor unit and the distribution device, for example, the first indoor unit is allocated with a first address, and the second indoor unit is allocated with a second address, ... , and the seventh indoor unit is allocated with a seventh address. In addition, each indoor unit further includes a wired controller, and each indoor unit further communicates with a respective wired controller.

[0055] Further, according to a specific example of the present disclosure, the outdoor controller in the outdoor unit communicates with the control module in the distribution device, meanwhile, the control module in the distribution device communicates with the indoor controllers in each indoor unit. The outdoor controller in the outdoor unit acquires temperature information of the outdoor unit (such as a temperature of the environment in which the outdoor unit is located, an exhausting temperature, a gas returning temperature, a heat exchange temperature, etc.), pressure information (such as an exhausting pressure, a gas returning pressure, etc.) and operating modes of each indoor unit sent by a plurality of indoor units and so on in real time to determine an operating mode of the multi-split system (such as a pure heating mode, a main heating mode, a pure cooling mode and a main cooling mode), and sends the instruction indicating the operating mode of the multi-split system to the distribution device. Meanwhile, the outdoor controller in the outdoor unit further controls the compressor and the outdoor fan, etc. to operate according to the inner logic output instruction signal.

[0056] Specifically, after the multi-split system is turned on, the outdoor controller in the outdoor unit acquires environment temperature information, pressure information of the outdoor unit and operating modes of each indoor unit to determine an operating mode of the multi-split system. For example, when each indoor unit operates under a cooling mode, the operating mode of the multi-split system is a pure cooling mode; when each indoor unit operates under a heating mode, the operating mode of the multi-split system is a pure heating mode; when there are both indoor units operating under a cooling mode and indoor units operating under a heating mode in the plurality of indoor units, the operating mode of the multi-split system is a simultaneous cooling and heating mode, and the outdoor unit sends corresponding mode instruction to the distribution device according to the determined operating mode of the system. Meanwhile, the outdoor unit controls the compressor and the outdoor fan, etc. to operate according to the inner logic output instruction signal. The distribution device controls each status parameter according to the mode instruction given by the outdoor unit.

[0057] Moreover, after the multi-split system starts operating, when a user performs a mode switching on the indoor unit, the indoor unit to perform a mode switching sends the switched operating mode to the distribution device **30**, and the distribution device **30** determines the opening or closing of a plurality of first controlling valves (such as the four first controlling valves **302**A, **302**B, **302**C, **302**D) and a plurality of second controlling valves (such as the four second controlling valves **303**A, **303**B, **303**C, **303**D) according to the switched operating mode.

[0058] Next, a specific description will be made by taking the indoor unit **24** as an example.

[0059] When the indoor unit **24** is under a cooling operating mode, as shown in FIG. **3** (FIG. **8**), FIG. **4** (FIG. **9**), the distribution device **30** controls the first on/off valve **302**D to open and the second on/off valve **303**D to close, and the indoor controller automatically controls the opening of the throttling element **242**. When the indoor unit **24** receives an instruction sent by the user indicating switching to a heating operating mode, the distribution device **30** controls the first on/off valve **302**D to close first, and the indoor controller controls the opening of the throttling element **242** to reach 480 P. After 60 seconds, the distribution device **30** controls the second on/off valve **303**D to open as shown in FIG. **2** (FIG. **7**), FIG. **5** (FIG. **10**), and thus the indoor unit **24** completes a switch to a heating operating mode from a cooling operating mode.

[0060] When the indoor unit **24** is under a heating operating mode, as shown in FIG. **2** (FIG. **7**), FIG. **5** (FIG. **10**), the distribution device **30** controls the first on/off valve **302**D to close and the second on/off valve **303**D to open, and the indoor controller automatically controls the opening of the throttling element **242**. When the indoor unit **24** receives an instruction sent by the user indicating switching to a cooling operating mode, the distribution device **30** controls the second on/off valve **303**D to close, and the indoor controller controls the opening of the throttling element **242** to reach 72 P for 30 seconds. Then, the indoor controller controls the opening of the throttling element **242** to reach 480 P so as to make the indoor unit **24** be filled with a medium-pressure liquid refrigerant. After 60 seconds, the distribution device **30** controls the first on/off valve **302**D to open again as shown in FIG. **3** (FIG. **8**), FIG. **4** (FIG. **9**), and thus the indoor unit **24** completes a switch to a cooling operating mode from a heating operating mode.

[0061] In addition, in embodiments of the present disclosure, when any one of the plurality of indoor units is under a cooling operating mode, the indoor unit may be controlled to be switched to a cooling standby mode, a cooling stopping mode or a heating operating mode; when any one of the plurality of indoor units is under a cooling standby mode, the indoor unit may be controlled to be switched to a cooling stopping mode or a heating operating mode; when any one of the plurality of indoor units is under a cooling stopping mode, the indoor unit may be controlled to be switched to a cooling operating mode or a heating operating mode; when any one of the plurality of indoor units is under a heating operating mode, the indoor unit may be controlled to be switched to a heating standby mode, a heating stopping mode or a cooling operating mode; when any one of the plurality of indoor units is under a heating standby mode, the indoor unit may be controlled to be switched to a heating stopping mode or a cooling operating mode; when any one of the plurality of indoor units is under a heating stopping mode, the indoor unit may be controlled to be switched to a cooling operating mode or a heating operating mode.

[0062] Specifically, when any one of the plurality of indoor units operates under a cooling mode, when a cooling standby mode or a cooling stopping mode sent by the user through a wired controller is received, none of the first controlling valve and the second controlling valve in the distribution device **30** operates, and the indoor controller in the indoor unit controls the opening of the throttling element to close after being maintained for 30 seconds.

[0063] When any one of the plurality of indoor units operates under a cooling mode, when a heating mode sent by the user through a wired controller is received, after receiving a heating start signal, the shunt apparatus **30** closes the first controlling valve corresponding to the indoor unit, and the indoor controller in the indoor unit controls the opening of the throttling element to close after being maintained for 30 seconds, then controls the opening of the throttling element to reach 480 P and to be maintained at 480 P for 60 seconds, closes the opening of the throttling element to an initial opening after 60 seconds, then performs adjustment according to PI. Additionally, after receiving the heating start signal for 105 seconds, the distribution device **30** opens the second controlling valve.

[0064] Switches between operating modes of other indoor units will not be described again here. In conclusion, in embodiments of the present disclosure, the distribution device **30** determines on or off statuses of the first on/off valve and the second on/off valve corresponding to the indoor unit according to a mode switching instruction, meanwhile the indoor controller in the indoor unit controls the opening of the throttling element according to the mode switching instruction so as to reduce the noise during the mode switching process.

[0065] By the multi-split system according to embodiments of the present disclosure, when any one of the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to a distribution device such that the distribution device determines on or off statuses of the first on/off valve and the second on/off valve corresponding to the indoor unit according to the mode switching instruction so as to ensure a small pressure difference between the front and back of the on/off valve when the indoor unit switches the mode, and thus noises generated due to a big pressure difference in the mode switching process may be effectively reduced, and the comfort level of users may be improved.

[0066] In the description of the present disclosure, it is to be understood that terms such as "central," "longitudinal," "lateral," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," "counterclockwise," "axial," "radial" and "peripheral" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present invention be constructed or operated in a particular orientation, therefore cannot be construed to limit the present disclosure.

[0067] In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, the feature defined with "first" and "second" may explicitly or implicitly comprises one or more of this feature. In the description of the present disclosure, "a plurality of" means two or more than two, unless specified otherwise.

[0068] In the present disclosure, unless specified or limited otherwise, the terms "mounted," "connected," "coupled," "fixed" and the like are used broadly, and may be, for example, fixed connections, detachable connections, or integral connections; may also be mechanical or electrical connections; may also be direct connections or indirect connections via intervening structures; may also be inner communications of two elements, which can be understood by those skilled in the art according to specific situations.

[0069] In the present disclosure, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each other, but are contacted via an additional feature formed therebetween. Furthermore, a first feature "on," "above," or "on top of" a second feature may include an embodiment in which the first feature is right or obliquely "on," "above," or "on top of" the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below," "under," or "on bottom of" a second feature may include an embodiment in which the first feature is right or obliquely "below," "under," or "on bottom of" the second feature, or just means that the first feature is at a height lower than that of the second feature.

[0070] Reference throughout this specification to "an embodiment," "some embodiments," "one embodiment," "an example," "a specific example," or "some examples" means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example are included in at least one embodiment or example of the present disclosure. In the specification, expressions of the above terms do not need for same embodiments or examples. Furthermore, the feature, structure, material, or characteristic described can be incorporated in a proper way in any one or more embodiments or examples. In addition, under non-conflicting condition, those skilled in the art can incorporate or combine features described in different embodiments or examples.

[0071] Although explanatory embodiments have been shown and described, it would be appreciated that the above embodiments are exemplary and cannot be construed to limit the present disclosure, and changes, amendments, alternatives and modifications can be made in the embodiments by those skilled in the art without departing from spirit, principles and scope of the present disclosure.

1. A multi-split system, comprising an outdoor unit, a distribution device, a plurality of indoor units, in which each indoor unit comprises an indoor heat exchanger and a throttling element, and the distribution device comprises a plurality of first controlling valves and a plurality of second controlling valves corresponding to each indoor unit,

when any one of the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to the distribution device;

the distribution device determines on or off statuses of a first on/off valve and a second on/off valve corresponding to the indoor unit according to the mode switching instruction.

2. The multi-split system according to claim **1**, wherein when any one of the plurality of indoor units is under a heating operating mode, the distribution device controls the second on/off valve corresponding to the indoor unit to open, and controls the first on/off valve corresponding to the indoor unit to close, and controls an opening of the throttling element in the indoor unit by an indoor controller in the indoor unit, in which

when the indoor unit receives an instruction indicating switching to a cooling operating mode, the distribution device controls the second on/off valve corresponding to the indoor unit to close, and controls the throttling element in the indoor unit to reach a standby opening by the indoor controller in the indoor unit;

the distribution device controls the throttling element in the indoor unit to reach a maximum opening by the indoor controller in the indoor unit after a first preset time so as to make the indoor unit be filled with a medium-pressure liquid refrigerant, the distribution device controls the first on/off valve corresponding to the indoor unit to open after a second preset time, in which the second preset time is longer than the first preset time.

3. The multi-split system according to claim **1**, wherein when any one of the plurality of indoor units is under a cooling operating mode, the distribution device controls the first on/off valve corresponding to the indoor unit to open, and controls the second on/off valve corresponding to the indoor unit to close, and controls an opening of the throttling element in the indoor unit by an indoor controller in the indoor unit, in which

when the indoor unit receives an instruction indicating switching to a heating operating mode, the distribution device controls the first on/off valve corresponding to the indoor unit to close, and controls the throttling element in the indoor unit to reach a maximum opening by the indoor controller in the indoor unit;

the distribution device controls the second on/off valve corresponding to the indoor unit to open after a second preset time.

4. The multi-split system according to claim **1**, wherein the multi-split system comprises a two-pipe heat recovery multi-split system and a three-pipe heat recovery multi-split system.

5. The multi-split system according to claim **1**, wherein

when any one of the plurality of indoor units is under a cooling operating mode, the indoor unit may be controlled to be switched to a cooling standby mode, a cooling stopping mode or a heating operating mode;

when any one of the plurality of indoor units is under a cooling standby mode, the indoor unit may be controlled to be switched to a cooling stopping mode or a heating operating mode;

when any one of the plurality of indoor units is under a cooling stopping mode, the indoor unit may be controlled to be switched to a cooling operating mode or a heating operating mode;

when any one of the plurality of indoor units is under a heating operating mode, the indoor unit may be controlled to be switched to a heating standby mode, a heating stopping mode or a cooling operating mode;

when any one of the plurality of indoor units is under a heating standby mode, the indoor unit may be controlled to be switched to a heating stopping mode or a cooling operating mode;

when any one of the plurality of indoor units is under a heating stopping mode, the indoor unit may be controlled to be switched to a cooling operating mode or a heating operating mode.

6. The multi-split system according to claim **2** or **3**, wherein the first preset time is in a range of 20 to 40 seconds, and the second preset time is in a range of 50 to 70 seconds.

7. The multi-split system according to claim **2**, wherein the standby opening is 72 P, and the maximum opening is 480 P.

8. The multi-split system according to claim **2**, wherein the multi-split system comprises a two-pipe heat recovery multi-split system and a three-pipe heat recovery multi-split system.

9. The multi-split system according to claim **3**, wherein the multi-split system comprises a two-pipe heat recovery multi-split system and a three-pipe heat recovery multi-split system.

10. The multi-split system according to claim **3**, wherein the first preset time is in a range of 20 to 40 seconds, and the second preset time is in a range of 50 to 70 seconds.

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